Algebra 2

Prerequisite: Geometry

A primary goal of Algebra 2 is for students to conceptualize, analyze, and identify relationships among functions. Students will develop proficiency in analyzing and solving quadratic functions using complex numbers. Students will investigate and make conjectures about absolute value, radical, exponential, logarithmic and sine and cosine functions algebraically, numerically, and graphically, with and without technology. Students will extend their algebraic skills to compute with rational expressions and rational exponents. Students will work with and build an understanding of complex numbers and systems of equations and inequalities. Students will analyze statistical data and apply concepts of probability using permutations and combinations. Students will use technology such as graphing calculators. Students will analyze situations verbally, numerically, graphically, and symbolically. Students will apply mathematical skills and make meaningful connections to life's experiences.

Standard I: Students will evaluate, analyze, and solve mathematical situations using algebraic properties and symbols.

Objective 1: Evaluate, analyze, and solve mathematical situations using algebraic properties and symbols.

a. Solve and graph first-degree absolute value equations of a single variable.
b. Solve radical equations of a single variable, including those with extraneous roots.
c. Solve absolute value and compound inequalities of a single variable.
d. Add, subtract, multiply, and divide rational expressions and solve rational equations.
e. Simplify algebraic expressions involving negative and rational exponents.

Objective 2: Represent and compute fluently with complex numbers.

a. Simplify numerical expressions, including those with rational exponents.
b. Simplify expressions involving complex numbers and express them in standard form, $a + bi$.

Objective 3: Model and solve quadratic equations and inequalities.

a. Model real-world situations using quadratic equations.
b. Solve quadratic equations of a single variable over the set of complex numbers by graphing, factoring, completing the square, and using the quadratic formula.
c. Solve quadratic inequalities of a single variable.
d. Write a quadratic equation when given the solutions of the equation.

Mathematical Language and Symbols Students Should Use
complex number, matrix

Standard II: Students will understand and represent functions and analyze function behavior.

Objective 1: Represent mathematical situations using relations.

a. Model real-world relationships with functions.
b. Describe a pattern using function notation.
c. Determine when a relation is a function.
d. Determine the domain and range of relations.

Objective 2: Evaluate and analyze functions.

a. Find the value of a function at a given point.
b. Compose functions when possible.
c. Add, subtract, multiply, and divide functions.
d. Determine whether or not a function has an inverse, and find the inverse when it exists.
e. Identify the domain and range of a function resulting from the combination or composition of functions.

Objective 3: Define and graph exponential functions and use them to model problems in mathematical and real-world contexts.

a. Define exponential functions.
b. Model problems of growth and decay using exponential functions.
c. Graph exponential functions.

Objective 4: Define and graph logarithmic functions and use them to solve problems in mathematics and real-world contexts.

a. Relate logarithmic and exponential functions.
b. Simplify logarithmic expressions.
c. Convert logarithms between bases.
d. Solve exponential and logarithmic equations.
e. Graph logarithmic functions.
f. Solve problems involving growth and decay.

Mathematical Language and Symbols Students Should Use
function, relation, $f(x)$, $f(g(x))$, $f \circ g$, exponential function, logarithm, base, e

Standard III: Students will model and solve problems applying geometric principles.

Objective 1: Examine the behavior of functions using coordinate geometry.

a. Identify the domain and range of the absolute value, quadratic, radical, sine, and cosine functions.
b. Graph the absolute value, quadratic, radical, sine and cosine functions.
c. Graph the solutions of absolute value and quadratic inequalities on the coordinate plane.
d. Graph functions using transformations of parent functions.
e. Write an equation of a parabola in the form $y = a(x-h)^2 + k$ when given a graph or equation.

Objective 2: Solve systems of equations and inequalities.

a. Solve systems of linear, absolute value, and quadratic equations algebraically and graphically.
b. Graph the solutions of systems of linear, absolute value, and quadratic inequalities on the coordinate plane.
c. Solve application problems involving systems of equations and inequalities.

Mathematical Language and Symbols Students Should Use
domain, range, parabola

Standard IV: Students will understand and apply measurement techniques, tools, and formulas.

Objective 1: Determine radian and degree measures for angles.

a. Convert angle measurements between radians and degrees.
b. Find angle measures in degrees and radians using inverse trigonometric functions, including exact values for special triangles.

Objective 2: Determine trigonometric measurements using appropriate techniques, tools, and formulas.

a. Define the sine, cosine, and tangent functions using the unit circle.
b. Determine the exact values of the sine, cosine, and tangent functions for the special angles of the unit circle using reference angles.
c. Find the length of an arc using radian measure.
d. Find the area of a sector in a circle using radian measure.

Mathematical Language and Symbols Students Should Use
radian, unit circle, reference angle

Standard V: Students will apply concepts and methods from probability and statistics to solve real problems.

Objective 1: Use percentiles and measures of variability to analyze data.

a. Compute and compare different measures of spread, including the range, standard deviation, and interquartile range.
b. Recognize situations in which the interquartile range might be more appropriate than the standard deviation or range.
c. Use percentiles to summarize the distribution of a numerical variable.
d. Use histograms to obtain percentiles.

Objective 2: Apply basic concepts of probability.

a. Distinguish between permutations and combinations and identify situations in which each is appropriate.
b. Calculate probabilities using permutations and combinations to count events.
c. Define conditional probability, and know and use the general multiplication rule for probabilities.
d. Compute conditional and unconditional probabilities in various ways, including by definitions, probability trees, and Bayes' Theorem.
e. Define simple discrete random variables.

Mathematical Language and Symbols Students Should Use
standard deviation, interquartile range, permutation, combination, conditional probability, Bayes' Theorem, discrete random variable